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***In Situ* Solid-State Synthesis of YAG and YIG from Citrate Prepared Precursors**

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Beamline(s): **X7B**

The YAG ($Y_3Al_5O_{12}$, yttrium aluminum garnet) and YIG ($Y_3Fe_5O_{12}$, yttrium iron garnet) are commercially important materials due to their mechanical, optical, electrical and magnetic properties. A new route to synthesizing these particles was attempted via a novel auto-ignition process of citrate and nitrate gels, and *in situ* X-ray diffraction was used to investigate the synthesis pathways of the YAG and YIG from the respective amorphous precursor materials [1]. The YIG precursor material transformed to a mixture of $YFeO_3$ perovskite (*Pnma*) and Fe_2O_3 hematite (*R3c*) below the formation of $Y_3Fe_5O_{12}$ garnet phase (*Ia3d*) at 1025 °C (Figure). On the other hand, the YAG precursor did not show any existence of intermediate phases before the formation of $Y_3Al_5O_{12}$ garnet phase (*Ia3d*) at 900 °C. This type of citrate method is now being directed to explore the effect of compositional variation on the formation of new garnet phases. *In situ* diffraction will continue to serve as a synthesis optimization and structural characterization tool.

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References:

[1] Devi, P. S.; Lee, Y.; Parise, J. B.; Sampath, S.; Grey, C. P.; Herman, H. *Chem. Mater.* **submitted**.

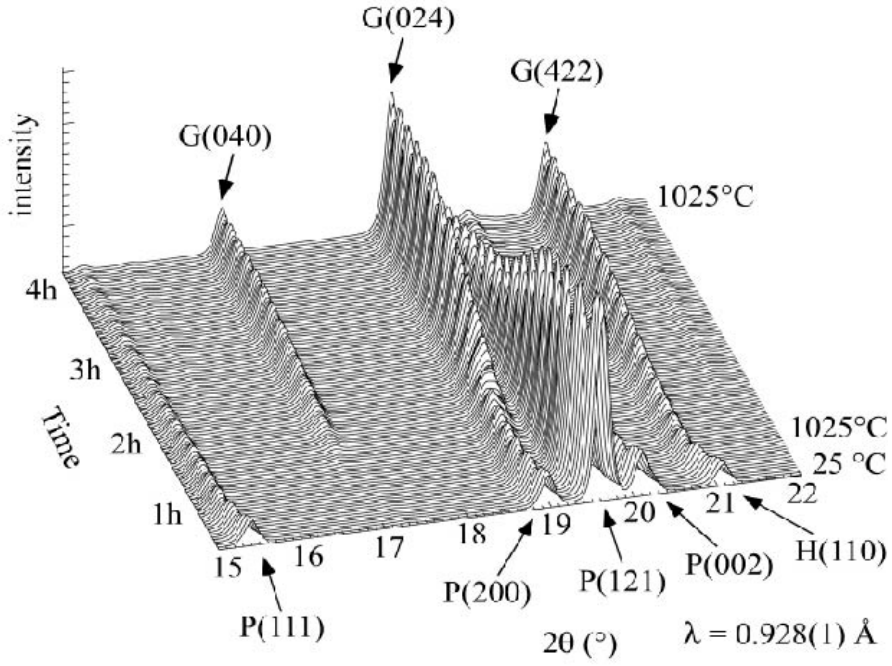

Figure. Time-resolved synchrotron X-ray powder diffraction patterns obtained during the heating of the YIG citrate precursor material. An intermediate mixture of orthorhombic perovskite (P) and hematite (H) phases is shown to convert into the YIG phase (G) at 1025 °C.